$$(A) \ldots (\iota x + \kappa y + \lambda z)(\iota x' + \kappa y' + \lambda z') =$$

$$\begin{aligned}
&(m_1^2 - l_2 l_3)\, xx' + (l_1 m_1 - m_2 m_3)(yz' + zy') \\
&+ (m_2^2 - l_3 l_1)\, yy' + (l_2 m_2 - m_3 m_1)(zx' + xz') \\
&+ (m_3^2 - l_1 l_2)\, zz' + (l_3 m_3 - m_1 m_2)(xy' + yx') \\
&+ (\iota l_1 + \kappa m_3 + \lambda m_2)(yz' - zy') \\
&+ (\kappa l_2 + \lambda m_1 + \iota m_3)(zx' - xz') \\
&+ (\lambda l_3 + \iota m_2 + \kappa m_1)(xy' - yx'),
\end{aligned}$$

then this expression, which he proposes to call a QUADRINOME, has many properties (associative, modular, and others), analogous to the quaternions ; which latter are indeed only that *case* of such quadrinomes, for which,

$$l_1 = l_2 = l_3 = 1,$$
$$m_1 = m_2 = m_3 = 0,$$
$$\iota = i,\ \kappa = j,\ \lambda = k.$$

He has, however, found another distinct sort of associative quadrinomial expression, which has also several analogous properties, and for which he suggests the name of TETRADS ; the product of two vectors being in it,

$$\begin{aligned}
(B) \ldots &(lx + my + nz)(lx' + my' + nz') \\
&+ (\kappa n - \lambda m)(yz' - zy') + (\lambda l - \iota n)(zx' - xz') \\
&+ (\iota m - \kappa l)(xy' - yx').
\end{aligned}$$

Dr. Allman communicated the results of some observations he had just made on *Aphanizomenon Flos-aquæ*. This minute alga had begun about three weeks previously to make its appearance in great abundance in the large pond of the Zoological Gardens. The best account we possess of the plant is in an excellent paper on the *Nostochineæ*, by Mr. Ralfs ;* but as the specimens from which Mr. Ralfs's description was drawn up were not in a recent state, some important points of structure have necessarily escaped him.

A. Flos-aquæ shows itself in the form of little fusiform fasci-

* On the *Nostochineæ*. By John Ralfs, M. R. C. S., Ann. and Mag. of Nat. Hist. May, 1850.

culi, of a pea-green colour, which are most frequently seen united to one another in larger bundles. This union of the primary fasciculi into secondary ones is not permanent, and under certain circumstances very imperfectly understood, but, in some cases, depending perhaps on meteorological conditions, the secondary fasciculi become broken up into primary ones, or, at least, into less complicated bundles, and the plant, which had previously lain upon the surface of the pond in an extensive stratum, becomes nearly uniformly diffused through the water. A return of the former conditions will again cause the union of the simpler fasciculi into more complex ones; and the reaccumulation of the plant in masses on the surface.

The primary fasciculi are composed of straight filaments, which are about $\frac{1}{3000}$th of an inch in diameter, and possess the three kinds of cells characteristic of the Nostochineæ, namely, the *ordinary cells*, the *heterocysts*, and the *sporangia*.

The ordinary cells vary much in length in different filaments, and even in the same filament, and not unfrequently they present evident transverse striæ, which doubtless indicate the commencement of division; the endochrome is in the form of minute oval or irregular masses. Under the action of iodine the contents of the cells assume a dark-brown colour, and separating from the walls contract towards the centre of the cell, where they appear bounded by a very definite outline (primordial utricle). The entire filament appears to be surrounded by an indistinct gelatinous (?) sheath.

When the aphanizomenon first showed itself in the pond, the heterocysts were abundant; but no sporangia could be detected. The heterocysts are in the form of short cylinders with rounded extremities, and with bluish-green contents, which scarcely ever present any trace of granular structure. Under the action of iodine the following structures may be seen in the heterocyst:—1. The endochrome contracted towards the centre of the cell, and presenting a well-defined boundary. 2. External to this, a delicate cell-wall separated from the con-

tracted endochrome by a transparent interval, and frequently presenting in its interior, at each extremity, a minute nucleus-like body, with strong refractive powers. 3. An external very delicate, but well-defined transparent investment, which is probably continuous with the general gelatinous (?) investment of the filament.

At first, no other kind of cell beyond those now described could be detected in the filaments, but in specimens gathered somewhat later many filaments presented in some part of their course a long cylindrical and slightly dilated cell, generally about two or three times the length of the heterocysts; occasionally a single filament presented two such cells. They correspond to the cells named sporangia in the other Nostochineæ; their contents are always minutely granular, and under the action of iodine contract towards the centre, and then present a very definite boundary, in which a double outline can sometimes be distinctly seen; while, external to this, and separated from it by a clear space, a colourless investing membrane has become very obvious; but the second investment, so evident in the heterocysts, could not here be satisfactorily demonstrated: the little spherical body visible at each extremity of the cell of the heterocyst could not be seen in the sporangium. Filaments bearing sporangia were accompanied by those bearing heterocysts, but whether the two kinds of cells ever coexisted in the same filament was not manifest.

That the sporangia are not simply enlarged cells, but the result of the union of several ordinary cells, is evident. The author has succeeded in observing them in intermediate stages of formation, in which the endochrome of a group of ordinary cells had already begun to assume the minutely granular condition of that of the sporangium, the septa being, at the same time, evidently in process of disappearing.

Aphanizomenon Flos-aquæ, after the death of the plant, is eminently sensitive to the action of light. Specimens dried on

paper in the shade are of a dull yellowish green; but if these be now exposed to the direct rays of the sun, for about ten minutes, they will be found to have assumed a bright bluish green, which they do not again lose.

During decomposition in water a fluid is produced, which is of a claret red under reflected light, but of a fine grass-green when viewed by transmitted light.

Dr. Allman also read a notice of a species of *Peridinea*, which had just shown itself in such inconceivable multitudes as to give rise to a peculiar coloration of some of the ponds in the Phœnix Park. During the last three weeks a spectator on the banks of the large ponds in the Park must have been struck by a brown colour assumed by the water. This colour was sometimes uniformly diffused through the water; at other times it appeared as dense clouds, varying from a few square yards to upwards of 100 in extent.

A microscopic examination of the water proved the brown colour to be entirely due to the presence of a minute organism, which the author preferred referring to the genus *Peridinea*, Ehr., rather than constructing for it a new one, though it does not exactly agree with any published generic description.

It is about the $\frac{1}{1000}$th of an inch in diameter, and approaches in form to a sphere divided by a deep annular furrow into two hemispheres, on one of which is situated another furrow, springing vertically from the annular furrow, and terminating at the pole. The author viewed the organism under consideration as essentially a solitary cell; it encloses reddish-brown granular contents, and a large, well-defined central nucleus. In the midst of the contents are numerous clear spaces, of various sizes, which, however, appear to be oil-drops rather than true vacuolæ.

In most instances a deeper-coloured ocelliform spot was evident near the polar extremity of the vertical furrow.